Economic Effects of Smoke-free Policies: The Bismarck and Mandan Restaurant and Bar Market from 2004 - 2012

Final Report for the Bismarck Tobacco-Free Coalition

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Executive Summary

Policy and economic controls have been used to affect behavior, access and impacts of tobacco use in the United States starting with post-revolutionary tobacco export taxes. Policy and taxation have a long history in the distribution and control of tobacco consumption. There is compelling economic rational to support government policy interventions to mitigate and limit the harm caused by the use of tobacco products. Modern economic theory posits government is justified in disrupting consumer sovereignty when there are impediments to competitive market structures. The tobacco industry exhibits evidence of at least three market failures: information about the health risks of smoking is not well understood by young smoking recruits or appropriately valued by long term addicts; the addictiveness of smoking leads to irrational decision making; and smokers do not bear the entire costs of inefficiencies and harm caused by smoking or social costs.

Quarterly total taxable receipts for the Bismarck market show a cyclical effect. This is consistent with the results of the earlier study (Pool et al., 2007) where a season pattern was identified in restaurant sales. The long term trend in annual and quarterly sales show strong and consistent increase in revenue for the restaurant market in Bismarck. Bismarck restaurant revenue growth outpaced both the national industry average, as well as, personal income growth in the state. Both are strong signs that the local economy was more resilient through the recession of 2009-10 than the industry as a whole and that the market is resistant to shocks such as reductions in disposable income. Over the entire period food service unadjusted growth averaged 8.0%, however when you exclude the recession that rate is 9.7% per year. Pre and post-recession growth rates were 10.0% and 9.1% respectively. North Dakota alcohol sales never dropped below 5% for any year regardless of economic condition. Pre and post-recession growth rates for alcohol sales were the same at 7.9% for both time periods. The highest level of growth for the bar industry was 9.9% during the worst period of the US recession. There is no evidence that growth rates in the food and beverage industry were ever significantly impacted by any smoke-free policy implementation or announcement.

Individual cohorts of similar sized establishments were impacted in both the positive and negative directions even though the overall market showed no signs of negative impacts from the bans. The majority of impacts were positive impacts on revenue streams with a few negative impacts where the negative impacts were mostly between 1 and 0.01% shifts. Even so, the most statistically significant negative results also tended to have the smallest magnitude revenue impacts. Positive effects were generally 10 to 1000 times larger than negative impacts but are difficult to generalize because there was a very large range of deviations and magnitudes. In most cases any negative impacts are small and temporary and revenue paths recover within a short period of time. The contradictory revenue responses suggest firm level impacts were influenced by exterior or exogenous impacts rather than from smoke-free policy enactment.

The response of the larger market is the higher priority because that is where the measure of public welfare is derived. The local markets tended to outperform the larger regional trends as well demonstrating significant resilience to national economic downturns. The

one state wide factor that may correlate to slowing revenue growth appears to be the decreases in disposable income at the state level during the peak of the recession. Even in this case the local restaurants still maintained a positive rate of growth during these events. The Bismarck food service industry also significantly outperformed the national food and beverage growth over the last 8 years.

During the analysis period there were significant new entrants into the market. Reporting restaurants increase from near 50 restaurants to nearly120 in Bismarck and from 25 to approximately 50 in Mandan over the analysis time frame. These large changes in market participation make the generalized market evaluation a more appropriate picture of the actual market response to policy and macroeconomic phenomenon. When a shift downward was observed for a cohort yet the overall market revenue stably increased, then revenue was redistributed to other market participants through competitive forces which are external to the policy at issue. There were no significant losses due to smoke-free policies, as markets continued to grow uninterrupted, losses at the individual level are attributable to competition within the market with other firms. So, revenue was redistributed by market forces rather than any reduction in demand attributable to policy changes.

Mandan as a control has many positive and negative shifts for events that happened in Bismarck. Many are philosophically inconsistent with rational expectation theory.

Just as in the 2007 study, it is evident that the Bismarck Restaurant/Bar market is both growing and becoming more competitive. During the timeframe of the study we more than doubled the number of firms and taxable revenue in the overall market. Competition between existing and with new firms seems to be the greatest contributor to revenue distribution.

The role of government is to set policy in the interest of the market as a whole including consumers and suppliers. Individual actors in the market did have different experiences than the market as a whole but the market was not disrupted by the role of policy. The health benefits of smoke free environments have been well documented. These benefits are not offset by any significant direct or indirect cost to restaurateurs in Bismarck, North Dakota.

Future research on these specific industry impacts are sufficiently addressed with this study and the 2007 study for Bismarck. These results are not unique. There is a growing set of published studies that show very similar results. Future research should focus on stemming youth recruitment to nicotine addictive products. Tracking hospital admissions for smoking related disease over time in conjunction with smoking restrictions will provide additional insights into the external benefits of the Bismarck and North Dakota health policies.

Economics Effects of Smoke-free Policy, D. Pool and R. Reich, 2013

Introduction

Policy and economic controls have been used to affect behavior, access and impacts of tobacco use in the United States starting with post-revolutionary tobacco export taxes to modern agricultural price supports initiated in 1933. Iowa was the first of the states to impose a state tax on cigarettes in 1921. However since the 1960's most public policy has been focused on limiting the negative health consequences attributed to tobacco consumption and by the 1990's the health impacts had expanded to consider the impacts of smoke on non-consumers or second hand smoke. This focus led to smoking bans on domestic airline flights, the Pro-Children Act of 1995 and the 1997 ban on smoking in government facilities. Policy and taxation have a long history in the distribution and control of tobacco consumption.

There is compelling economic rational to support government policy interventions to mitigate and limit the harm caused by the use of tobacco products. Modern economic theory posits government is justified in disrupting consumer sovereignty when there are impediments to competitive market structures. The tobacco industry exhibits evidence of at least three market failures: information about the health risks of smoking is not well understood by young smoking recruits or appropriately valued by long term addicts; the addictiveness of smoking leads to irrational decision making; and smokers do not bear the entire costs of inefficiencies and harm caused by smoking or social costs. Social costs are synonymous with external costs or the term externalities. The social costs imposed by smoking on people other than smokers themselves, as well as those costs borne by smokers and their families that result from addictive rather than voluntary consumption are all signs of market failure (Scollo and Winstanley, 2008). The prescriptions for market failures lie in the purview of policy.

The use of policy can be targeted toward various components of tobacco use and impacts. For instance the use of tax mechanisms directly impacts who can afford to smoke. The elasticity of demand for young potential smokes is higher than it is for adult smokers. Therefore tax policy can have direct and targeted impacts limiting the recruitment of youth to nicotine based tobacco products because the tax burden is passed on to the consumer and youth purchases of tobacco are more price sensitive than adult consumers. Policy is used to set quotas for farmers, limiting who can grow tobacco and how much can be grown to retard the supply and maintain prices for growers. In 1965 federal policy require tobacco companies to include the Surgeon General's warning regarding the harmful health consequences on tobacco packages. The evolution of restrictive policy has culminated in the clean air policies of workplaces and public establishments since the 1990's.

Bismarck joined this trend in October 2005 with the enactment of a local smoke free ordinance. Smoke free zones as policy are not designed to change consumptive behavior but are designed to protect the health of those who do not wish to consume cigarettes and the 33 documented carcinogens contained in cigarette smoke, vapor and residue (NTP 2011). During public hearings for the ordinance, much of the debate centered on the theory the new policy would create an economic burden on affected industries (e.g. restaurants and bars). Testimony at the time indicated concern that, without smoking, the

restaurant and bar industry would see a precipitous decline in revenue and the policy would therefore be overly burdensome on a narrow set of private business owners. The Bismarck Tobacco Free Coalition commissioned a sales tax study in 2007 to see if there were any early signs of economic impacts to local restaurants. That earlier study did not find any indications of negative impacts from the ordinance on sales tax revenue resulting from the ordinance.

The results of the 2007 Bismarck sales tax study were consistent with other studies at that time; Scollo et al (2003) found that earlier studies reported no impact of smoke free restaurant and bar laws on sales or employment. Peer reviewed research since that time has been consistent with the 2007 Bismarck results. Studies in Massechusetts (Alpert et al., 2007), New York (Engelen and Farrelly, 2006), Colorado and California (Costas et al., 2013) and even Europe (Melberg and Lund, 2012) as well as a significant literature review (Costas et al., 2013) all show there is little, no, or even positive economic impacts from policies that ban smoking in restaurants and bars.

The history of bar and restaurant ordinances passed by the city of Bismarck and state of North Dakota have been progressively more restrictive than earlier ordinances. The North Dakota state legislature passed the first law in August 2005 but the enactment date was after the effective date of the first Bismarck ordinance (Table 1.) A more comprehensive ordinance was read and debated in the 3rd quarter of 2010 which led to a successful public petition in the 4th quarter of 2010 setting a vote on the ordinance in the 2nd quarter of 2011. Opinion surveys preceding the ordinance passage showed that 75% of the Bismarck community and the small adjoining community of Mandan would support the passage of a law that eliminated all tobacco smoke from restaurants (Winkelman, 2004). The ordinance did pass and was enacted in the same quarter. The Bismarck comprehensive ordinance was then followed by a statewide ballot initiative that passed and was enacted in the 4th quarter of 2012.

A common reaction to new policy is to assume that additional constraints lead to negative economic consequences. This leads to the perception the suppliers are bearing the cost of social policy even if it is in the best interest of the consumer (Pool 1994). During the discussion over each law and ordinance, the North Dakota Hospitality Organization claimed the ordinance would create economic hardship for the restaurant/bar industry. Based on the results of the earlier study there was no support for the Hospitality Associations assertions. With seven additional years of data we are better prepared to address the short term and long term impacts of smoking bans on bars and restaurants.

In the first study we tested the announcement effects and the implications on sales tax revenue, in this study we can evaluate better the passage of particular legislation along with enactment. The economic implications of government policy can result in externalities or effects beyond the specific targeted response anticipated by the policy. Externalities can be either beneficial or detrimental. Prior to a public policy debate Lubbrook et al. (2005) conducted a meta-analysis of smoking study results and found an impact on the growth of restaurant revenues of +0.25% (95% CI: –1.32% to +1.81%) and bar sales as a fraction of retail sales was reported as +0.5% (95% CI: –0.284% to +1.284%). These results are typical of other peer reviewed results which demonstrate

insignificant differences in revenue but that are generally positive or increase revenue or resale value of restaurants and bars (Melberg and Lund, 2012; Young et. al., 2010; Almar and Glanz, 2007).

Table 1. Specific dates and events in the history of Bismarck tobacco bans.

Date	Public Policy Event	Indicator
August, 2005	Statewide smoke free restaurant/workplace law passed.	I1
October 11, 2005	Smoke free Restaurant ordinance passed and enacted immediately. Stronger than the statewide law. Stand-alone bars, hotel bars and truck stops exempt from smoking prohibitions.	
August 12, 2010	First reading of a comprehensive smoke free city ordinance.	
August 24, 2010	Public hearing of the ordinance and passage by the Bismarck City Commission.	
September 28, 2010	Public hearing for amendment added to the ordinance to include smoking shelters. Enactment set for Nov 1, 2010.	
October 25, 2010	Announcement of successful petition drive for ordinance referral and date of election will be set. No enactment until after the election.	I3
April 19, 2011	Date of election. Referral of comprehensive smoke free ordinance failed. Public supported the ordinance.	I4
April 27, 2011	Ordinance enacted.	I4
August, 2012	Announcement of successful petition drive for placing a statewide comprehensive smoke free law on the November ballot.	
November 6, 2012	Date of election. Comprehensive smoke free law passed.	I5
December 6, 2012	Statewide law enacted.	I5

Certain externalities can be identified by responses in prices, revenue or expense in other industries. A major supposition of the proponents of the smoke-free ordinances has been that, reductions in the costs associated with smoking related disease are positive externalities resulting from clean air ordinances. As a part of this study we reviewed the literature and found admission rates for smoking-related diseases were significantly reduced in the city that implemented a smoking ban (Bowling Green, Ohio) compared to the control city (Kent, Ohio). The smoking related disease that responded with the greatest significant magnitude was coronary heart disease, which decreased significantly with a 39% reduction in hospital admission after 1 year and by 47% fewer admission after only 3 years after the implementation of the ordinance.

Economic Theory

Price effects resulting from government policies are tools by policymakers to evaluate the consequences of public policy. These effects in the context of bars and restaurants can manifest themselves in two expected forms: 1) a gradient shift in the tax revenue stream, 2) a change in the relative slope of the tax revenue stream. Smoking bans in bars and restaurants have both direct and indirect costs and benefits. The specific debate addressed by this study is centered on the impacts on local restaurant and bar revenue. Tobacco industry supporters continue to extoll rhetoric implying theoretical harm from policy rather than empirical evidence from observational studies. The 2007 study had a limited number of quarters post policy to consider the impacts and the policy has continued to evolve into more restrictive bans. Though there is growing evidence in the published literature each community has the potential to respond uniquely to these policies. This study will address sales tax revenue over a longer period of time and test impacts for a greater number of policy events.

The two mechanisms, through which altered behavior from policy will be detected, can be thought of as a shift up or down of the line representing the revenue stream or a tilt (change in the slope) of that line. Patrons that are affected by the policy will respond differently depending on whether they perceive themselves to be benefactors of or deprived by the policy. Those who benefit will summarily await the altered environment before engaging. Those who are deprived of smoking in public will not adjust their behavior or abandon the establishment until the barrier to behavior is enacted. This can be seen when graphed as revenue for the industry over time (Figure 1).

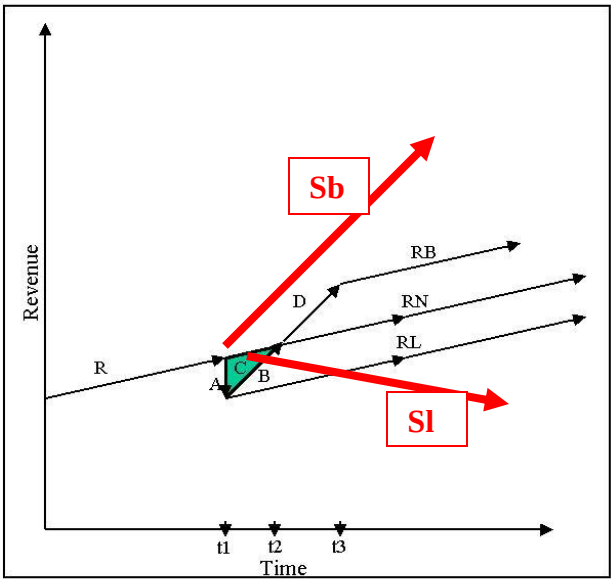


Figure 1. Potential responses from the market to regulation.

The figure shows R as the historic revenue stream over time. T1 can reflect either an announcement or enactment of policy. At t1 smokers are expected to withdraw from patronage “A” leaving a drop in revenue. If this loss of patronage persists then RL will be the new revenue stream for the market. If either a combination of repatriation by smokers or new recruitment of customers begin to frequent the industry over time “B”; revenue will increase and return to RN where long term market effects are neutral, or possibly increase “D” to RB where industry will benefit through greater market participation from the effects of regulation. “C” represents the loss to industry as a result of a market shock to equilibrium and the resulting return to market equilibrium over the time period t1 to t2. This would be the case if regulation did not recruit new patrons and smokers returned or if all disenfranchised smokers were replaced by equivalent additional participation in the market. The red lines indicate the impact of a change in the growth rate for revenue over time. The line represented by Sb indicates an increase in patronage that continues over time and Sl a continuous decline in revenue growth over time after the policy is enacted.

Data and Methods

State reported taxable sales revenue was used as a proxy for total revenue to quantify the impacts of regulation to the local restaurant and bar market. The sales revenue data were provided by the North Dakota Office of Tax Commissioner (NDOTC). These data were subject to legal disclosure and privacy constraints. The NDOTC is limited by ND Century Code 57-39.2-23 and policy, such that, data had to be delivered in blocks large enough that proprietary information about any individual entity was sufficiently obfuscated to meet privacy standards. The NDOTC provided taxable revenue for all full-service restaurants and bars for both Bismarck and Mandan.

The taxable sales reported by full-service restaurants in Bismarck and Mandan that reported for all periods over the study period were delivered in groups of five. Data were provided for all quarters starting with calendar year 2004 through fourth quarter 2012. The data were sorted at NDOTC on total taxable sales for all years and then separated into groups of five so that each group of five represents a cohort of similar revenue establishment. These data were separated into four data sets Bismarck restaurants, Bismarck bars, Mandan restaurants, and Mandan bars.

A second series of data were delivered showing all reporting entities including those that did not report in every quarter. These data were used to evaluate the overall market trend. The data were not CPI adjusted since the same adjustment would be applied equally to all values and would result in only a scalar adjustment. Such adjustments do not affect the statistical significance of any potential impact and since localize CPI adjustments were not available past 2008 application of the adjustments would have limited the span of years for assessment. There were no delinquencies in the data.

The length of time for the analysis spans the market preceding the implementation of smoking bans and far enough afterwards to capture the new character of the revenue function over time for most events. The final enactment of the statewide referendum has only one time period for post analysis.

The data were analyzed as a whole for overall market characterization and broken down to their component parts when the number of firms and observations are large enough for statistical inferences to be credible. Analyses were performed using indicator or dummy variables to represent specific time periods for before and after effects (Pool 1994). Firm size was represented as a parameter in a slope-intercept model to compare distinct before and after effects (Steele and Torrey 1980).

To study the effects of non-smoking policies piecewise regression was used to model tax revenues over a nine year period (2004-2012). Piecewise linear regression was used to divide the time series data into five sub-periods and fit a regression model for each segment. It is a special case of a larger set of models or relationships, referred to as spline functions. The structural breaks in a time series data may be single or multiple depending on the nature of data, which can be determined by optimization statistics or prior knowledge. Piecewise regression is useful in dividing time series data into two or more sub-periods of homogeneous change which provides more precise and stable estimates of parameters of growth behavior in sub-periods.

To fit the regression model the fiscal quarters (t) were numbered consecutively from 1 to 36. Next, indicator variables were introduced in the model to test if the slope and intercept of the regression function describing the change in tax revenues over the fiscal quarters changed significantly when a non-smoking announcement, legislative action and enactment of policies occurred. The fiscal quarters tested in the model were

I_1 – 3rd Quarter, 2005 (t = 7)
I_3 – 3rd Quarter, 2010 (t = 27)
I_4 – 2nd Quarter 2011 (t = 30)
I_5 – 4th Quarter, 2012 (t = 36)

For, example if it was known that tax revenues changed significantly in the 3rd fiscal quarter in 2005, the regression model describing this relationship is given by

$$Y_t = \beta_0 + \beta_1 t + \beta_2 I_1 + \beta_3 (t-7) I_1 + \varepsilon_t$$

where Y_t is the tax revenue in fiscal quarter t, the β_i's are the regression coefficients and I_1 is an indicator variable that equals 1 if the fiscal quarter is greater than 7 and zero otherwise. To check that the model does provide a two-piecewise linear regression consider the above response function. When $t \leq 7$, $I_1 = 0$ so the equation becomes

$$E[Y_t] = \beta_0 + \beta_1 t, \qquad t \leq 7.$$

On the other hand, when $t > 7$, $I_1 = 1$ and we obtain

$$E[Y_t] = (\beta_0 + \beta_2 - 7\beta_3) + (\beta_1 + \beta_3) t, \qquad t > 7.$$

Hypothesis testing can be performed to test whether or not $\beta_2 = 0$ and/or $\beta_3 = 0$. If for example, it is concluded that $\beta_2 \neq 0$ and $\beta_3 = 0$ the regression function is continuous at t =

7, but with a different slope (i.e., a significant change in revenues). If $\beta_2 \neq 0$ and $\beta_3 \neq 0$ then the regression function will be discontinuous at t = 7 and have different slopes. Finally, if $\beta_2 = 0$ and $\beta_3 \neq 0$, the regression function will be discontinuous at t = 7 but with the same slope.

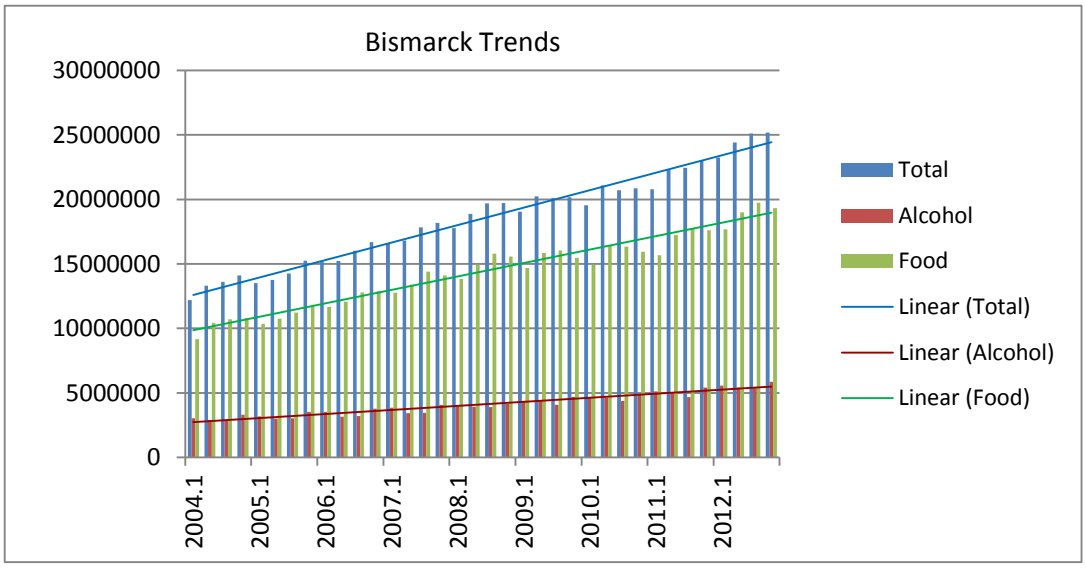
Finally, to account for seasonal variability in tax revenues, two trigonometric function were added to the model: $cos\left(\frac{2\pi t}{T}\right)$ and $sin\left(\frac{2\pi t}{T}\right)$, where t is the fiscal quarter T = 4 is the number of quarters in the fiscal year.

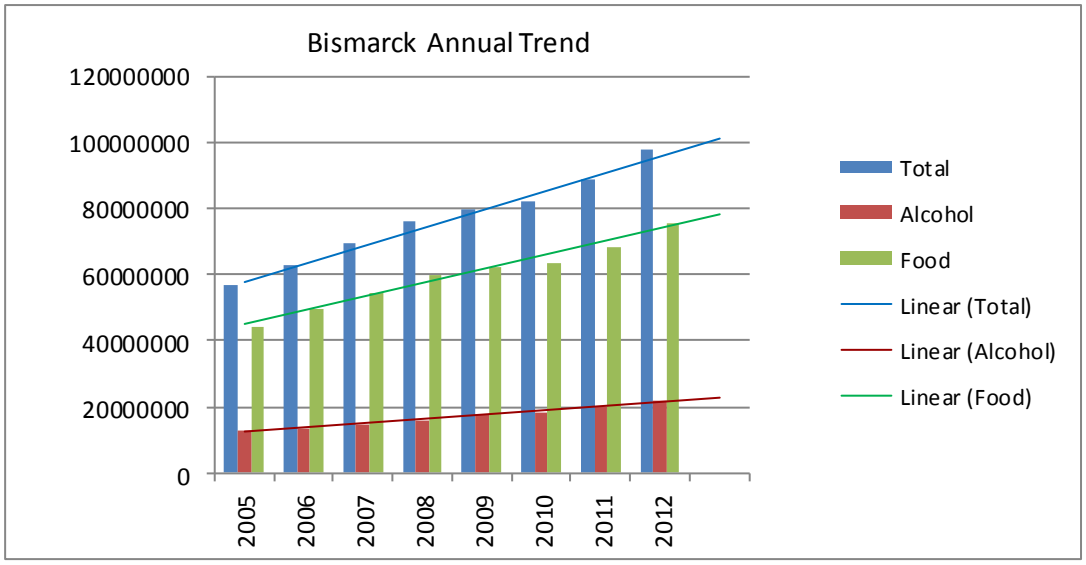
A stepwise Akaike's information criterion (AIC) procedure was used to find the best set of variables that minimized the AIC units. Only variables significant in explaining the change in taxable revenues over time were retained in the final model (Burnham and Anderson, 2002). The FIT statistic which is defined as the square of the correlation between the observed and predicted values squared was used as a measure of the goodness-of-fit.

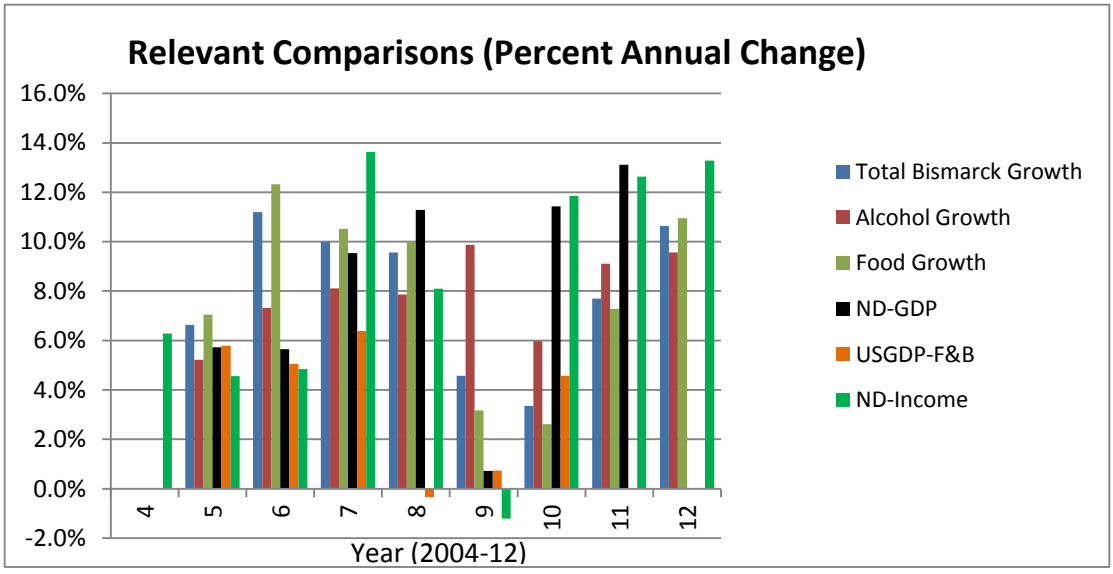
The above procedures were applied to all analyses including taxable sales receipts for 5 revenue cohorts identified for Mandan and 8 revenue cohorts for Bismarck and whether the taxable revenues were generated from liquor sales or from food sales associated with restaurants in the two cities.

Results

Bismarck: Quarterly total taxable receipts for the Bismarck market show a cyclical effect. This is consistent with the results of the earlier study (Pool et al., 2007) where a season pattern was identified in restaurant sales. The long term trend in annual and quarterly sales show strong and consistent increase in revenue for the restaurant market in Bismarck. Bismarck restaurant revenue growth outpaced both the national industry average, as well as, personal income growth in the state. Both are strong signs that the local economy was more resilient through the recession of 2009-10 than the industry as a whole and that the market is resistant to shocks such as reductions in disposable income.

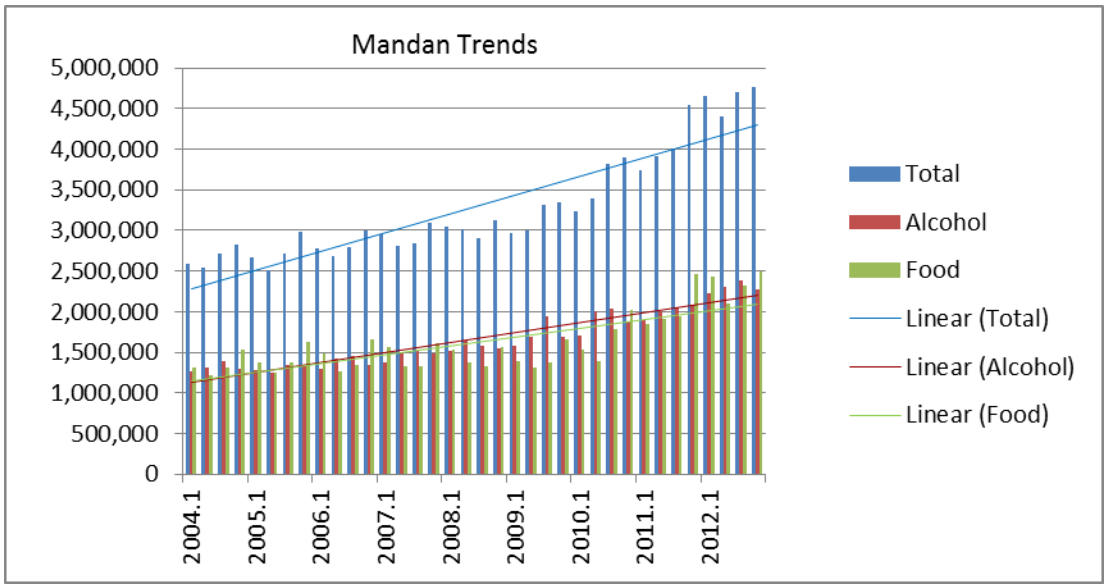

Bismarck Trends
30000000
25000000
20000000
15000000
10000000
5000000
0
2004.1
2005.1
2006.1
2007.1
2008.1
2009.1
2010.1
2011.1
2012.1
Total
Alcohol
Food
Linear (Total)
Linear (Alcohol)
Linear (Food)

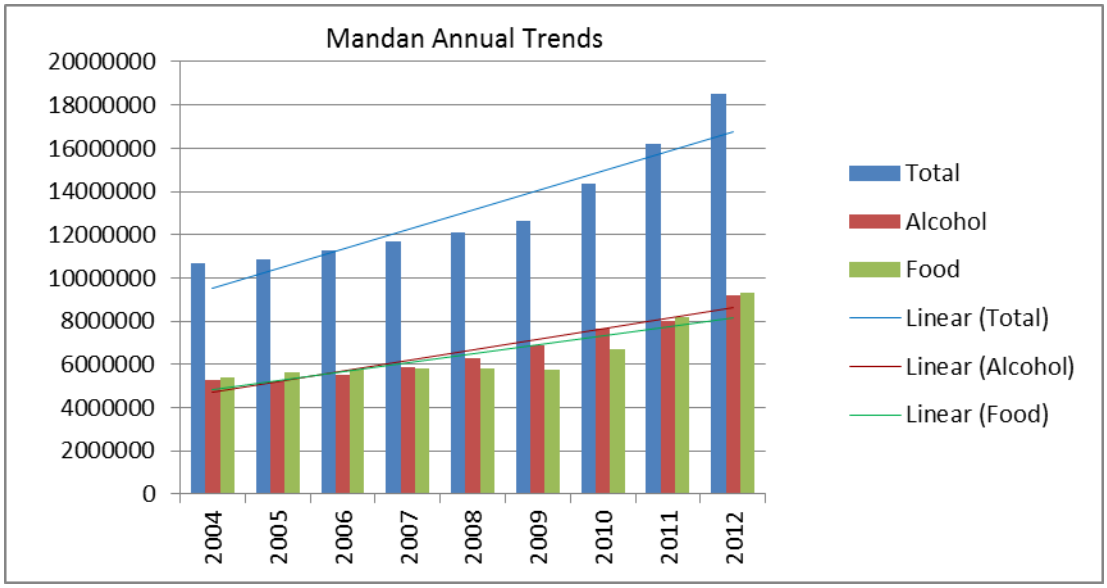

Bismarck Annual Trend
120000000
100000000
80000000
60000000
40000000
20000000
0
2005
2006
2007
2008
2009
2010
2011
2012
Total
Alcohol
Food
Linear (Total)
Linear (Alcohol)
Linear (Food)


Relevant Comparisons (Percent Annual Change)
16.0%
14.0%
12.0%
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
-2.0%
4
5
6
7
8
9
10
11
12
Year (2004-12)
Total Bismarck Growth
Alcohol Growth
Food Growth
ND-GDP
USGDP-F&B
ND-Income

Bismarck demonstrated positive revenue increases for each year through the entire study period. The food service industry growth outpaced North Dakota Gross Domestic Product (GDP) growth in all years prior to the recession. During the recovery period after the recession Food Service growth remained positive but overall state GDP growth exceeded the industry growth rate. Over the entire period food service unadjusted growth averaged 8.0%, however when you exclude the recession that rate is 9.7% per year. Pre and post-recession growth rates were 10.0% and 9.1% respectively. Alcohol growth was consistent with historic rates for periods of recession. Alcohol sales tend to increase when the US is in a recession. North Dakota alcohol sales never dropped below 5% for any year regardless of economic condition. Pre and post-recession growth rates for alcohol sales were the same at 7.9% for both time periods. The highest level of growth for the bar industry was 9.9% during the worst period of the US recession.

Mandan: Quarterly total taxable receipts for the Mandan market also show evidence of a cyclical effect. This is consistent with the Bismarck results and that of the earlier study (Pool et al., 2007). The long term trend in annual and quarterly sales show strong and consistent increase in revenue for the restaurant market in Mandan. Mandan restaurant revenue growth outpaced the national industry average (3.69%) growing at an unadjusted rate of 7.4% over the study period slightly behind North Dakota personal income growth at 8.2%. Bar sales were only slightly below restaurants at 7.3% per year average growth. As in the Bismarck case the Mandan market exhibited local economic resilience through the recession of 2009-10.





Piece-wise Analysis:
The results of these analyses vary greatly between cohorts. The mere fact a time period is significant to the model, does not suggest causation in either a positive or negative sense. Other factors that influence local, regional and national economies are not segregated from the cohort models. Individual cohorts also demonstrate different responses over the timeframe of this study than the grouped data which represents the overall market presented in the previous section.

Overall Significance:
Testing for coefficient values greater or less than zero was conducted on all coefficients that were included in the best fitting model. Not all coefficients were significantly different from zero even if the variable may have been included to fit the model itself. We provide the probability that each coefficient is zero in the table below and in more detail in Appendix 1. We include + and – signs for coefficients with reasonable probabilities (0.05%) of significance and all other parameter coefficients with less significance but that are included in the model are denoted with an 'X'.

When interpreting these data it is the combined significance or confidence we have in the parameters importance to describing the revenue stream and the magnitude or amount the parameter affects the revenue stream. The table below is an incomplete assessment without returning to the output results to evaluate the sensitivity of the model to each individual parameter.

Potential impacts to revenue can be seen, throughout the market that coincide with several policy periods. The results identify both positive and negative impacts associated with specific policy periods. In general the majority of impacts are positive impacts on revenue streams with a few negative impacts. Overall the negative impacts were mostly between 1 and 0.01% shifts though there are a few that exceed that range. The most significant negative results also tended to have the smallest revenue impacts. The impacts of positive responses were generally 10 to 1000 times larger than negative impacts but are difficult to generalize because they have a very large range of impact. In most cases any negative impacts are small and temporary and revenue paths recover within a short period of time.

Bismarck

Food

Cohort	FIT Statistic		Significance of coefficient at p-levels: 0.001(+++,---), 0.01(++,--), 0.05(+,-); X = in the model; β_3/β_2 (slope/intercept)			
	Fitted Model	Trend	I1 - 2005.3	I3 -2010.3	I4 - 2011.2	I5 - 2012.4
1	0.80	0.77	X/X		X/+	
2	0.95	0.63	--	X	X/+	
3	0.75	0.45	---	+	+++	
4	0.79	0.65	--	++	X	
5	0.86	0.52			+++	

6	0.86	0.66	+++/+			++
7	0.77	0.57			+++	X
8	0.73	0.55	-		+++	

Liquor

Cohort	FIT Statistic		Significance of coefficient at p-levels: 0.001(+++,---), 0.01(++,--), 0.05(+,-); X = in the model; β_3/β_2 (slope/intercept)			
	Fitted Model	Trend	I1 - 2005.3	I3 -2010.3	I4 - 2011.2	I5 - 2012.4
1	0.82	0.65	++	+	X	
2	0.92	0.90	X			
3	0.92	0.52	+++		+++	
4	0.90	0.87	---	++	++	
5	0.87	0.54	++/+++		X	
6	0.74	0.30	X	X		+
7	0.83	0.41	X		---	
8	0.73	0.46			+++/--	+++

Mandan

Food

Cohort	FIT Statistic		Significance of coefficient at p-levels: 0.001(+++,---), 0.01(++,--), 0.05(+,-); X = in the model; β_3/β_2 (slope/intercept)			
	Fitted Model	Trend	I1 - 2005.3	I3 -2010.3	I4 - 2011.2	I5 - 2012.4
1	0.95	0.14	---		++	
2	0.93	0.70	-		+++	--
3	0.88	0.81	+++/---		X	
4	0.57	NA	++/X			+

Liquor

Cohort	FIT Statistic		Significance of coefficient at p-levels: 0.001(+++,---), 0.01(++,--), 0.05(+,-); X = in the model; β_3/β_2 (slope/intercept)			
	Fitted Model	Trend	I1 - 2005.3	I3 -2010.3	I4 - 2011.2	I5 - 2012.4
1	0.92	0.15	---			
2	0.93	0.63	+++	X	+	X
3	0.91	0.16	++	X	+++/X	X
4	0.69	0.63	++		+	+

Mandan was somewhat unique because all establishments were impacted in the third quarter of 2005. The smaller establishments in Mandan were more effected in later time periods. Some Mandan establishments experienced small magnitude negative impacts but revenue paths were at expected trajectories or better by 2012.

Bismarck Restaurants:

The largest Bismarck restaurants are in cohort 2. The time period associated with the statewide law does not show a direct loss in revenue however revenue growth after that period was at a reduced pace than previous to that point. The seasonal or cyclical revenue stream is still evident with the overall trend exhibit slow but consistent growth from 2005 thru 2010 including the years spanning the US recession. Coincident with the Bismarck referendum and then the statewide ballot initiative there were both direct increases in revenue and an accelerated growth in revenue. Revenues gradients during these policy periods jumped $63,776 and $113,420 (5.9%) jump in revenue (+/- 72,635; 106,790 respectively, the first effect is not significant and the second is significant ($\alpha = 0.05$). The combination of these effects exceeded the impacts of the earlier reduction in slope and produced a revenue level and growth rate that exceeds what would have been expected from national and state growth indices.

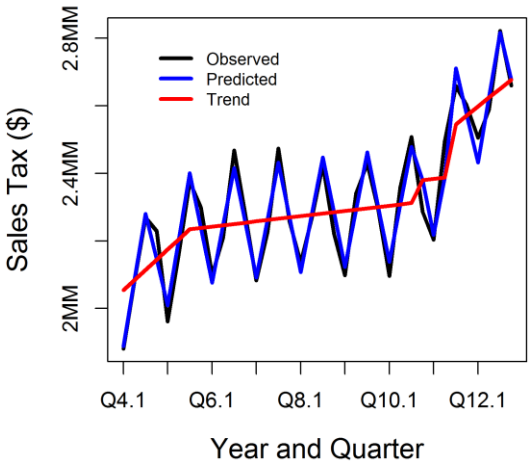


Figure 2: Bismarck food taxable sales cohort 2

This cohorts liquor sales experience a revenue drop of $7694 (+/- 8169, $\alpha = 0.05$) or after the announcement of the statewide law but at the time of the Bismarck ordinance observed values of the direct revenue drop had recovered. This decrease in revenue was not statistically significant ($\alpha = 0.05$) due to the highly variable revenue from quarter to quarter (zigzag pattern). Though we show the potential impact time period I1 was important to fitting the model it was however not significant on its own. The revenue trend began to recover almost immediately and was fully recovered by 2010.

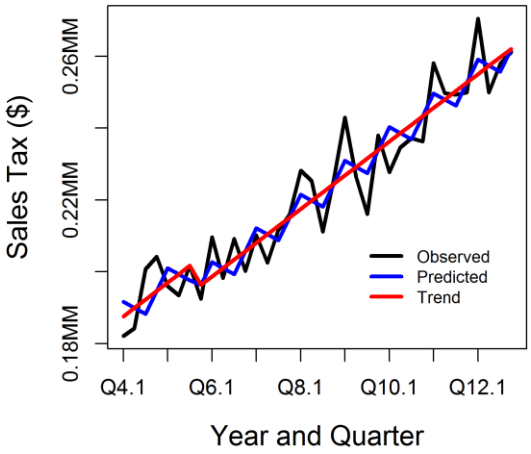


Figure 3: Bismarck liquor taxable sales cohort 2

The second largest Bismarck restaurants, cohort 1, experienced a large positive increase in revenue and a stagnation of growth after period I1. These values were not statistically significant ($\alpha = 0.05$) and also saw a statistically significant increase in revenue after the Bismarck Referendum (I4) along with an increase in growth which was not significant at $\alpha = 0.05$.

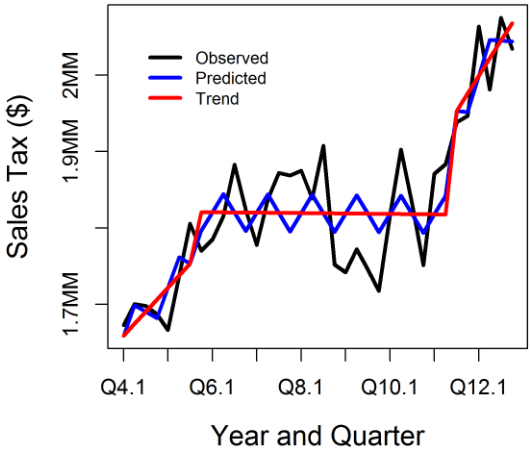


Figure 4: Bismarck food taxable sales cohort 1

Liquor sales for this cohort experience statistically significant ($\alpha = 0.05$) increases in revenue after the passage of the statewide ban and the announcement of the Bismarck referendum. The period following the Bismarck vote shows weak evidence of slower growth though it is not statistically significant ($\alpha = 0.05$).

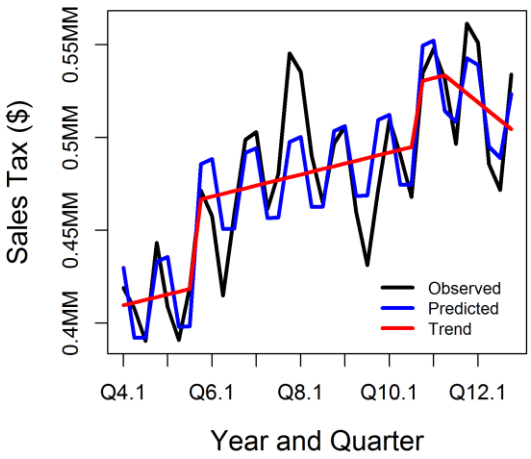


Figure 5: Bismarck liquor taxable sales cohort 1

Cohort 3 experience a significant decline in growth following the statewide law that was however more pronounced in the later quarters of 2008 – 2009. This group was identified in the 2007 study as one of the size classes most susceptible to revenue loss from new entrants into the market. These results are coincident with the impacts demonstrated in the previous study. The announcement of the Bismarck referendum coincided with $55,005 increase in revenue and upon passage of the referendum the growth of revenue exceeded the pre-tobacco ban rate of growth and revenues now exceed pre-ban projections.

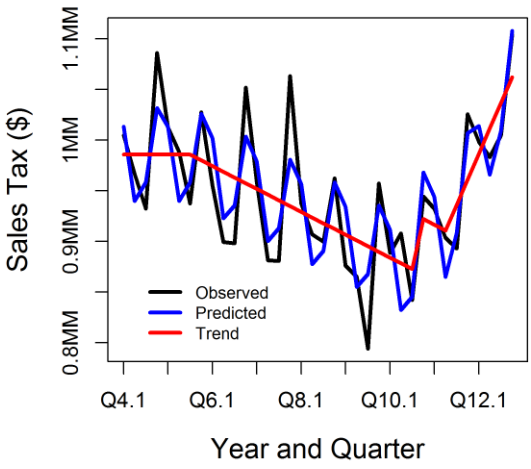


Figure 6: Bismarck food taxable sales cohort 3

Liquor sales for cohort 3 experienced positive and significant increases in growth after both the statewide law and the passage of the Bismarck referendum. This cohort was experiencing a significant contraction in revenue prior to the 2005 ban. All impacts were significant to $\alpha = 0.001$.

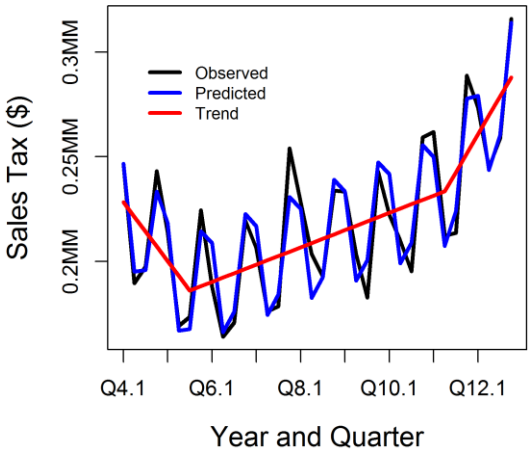


Figure 7: Bismarck liquor taxable sales cohort 3

Bismarck cohort 4 restaurants revenue growth after the statewide ban period was at a reduced pace than previous to that point. The seasonal or cyclical revenue stream is still evident with the overall trend exhibit a nearly flat trajectory from 2005 thru 2010. Coincident with the Bismarck referendum announcement and then the referendum vote there were both direct increases in revenue and an accelerated growth in revenue. Revenues gradients coincident with the Referral announcement period jumped $66,601 ($\alpha = 0.05$). The combination of these effects exceeded the impacts of the earlier reduction in slope and produced a revenue level and growth rate that exceeds national and state growth indices.

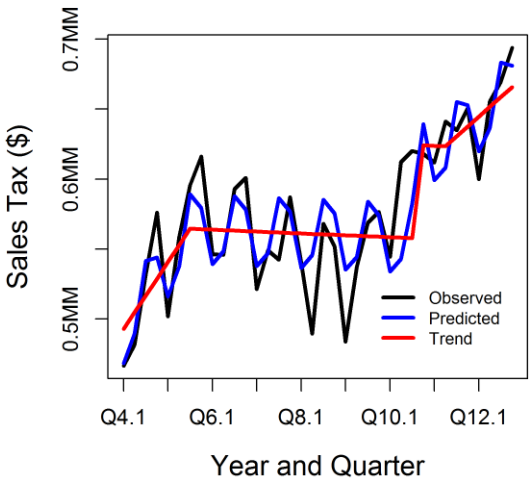


Figure 8: Bismarck food taxable sales cohort 4

Cohort 4 liquor sales track closely with the food receipts. Growth flattened near the time of the statewide law and Bismarck announcements. Coincident with the Referral

announcement and vote there were gradient shifts in revenue streams of $65,558 and $69,360 respectively. The between periods growth rate (trend) remained relatively flat in spite of the jumps in revenue.

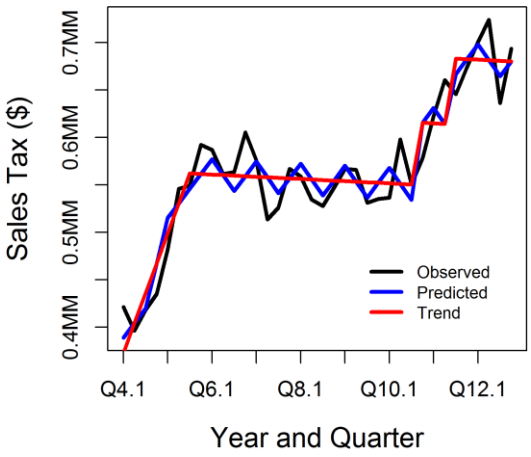


Figure 9: Bismarck liquor taxable sales cohort 4

Cohort 5 experience little disruption to their revenue stream. The only significant impact was a change in the rate of growth after the vote on the Bismarck referendum.

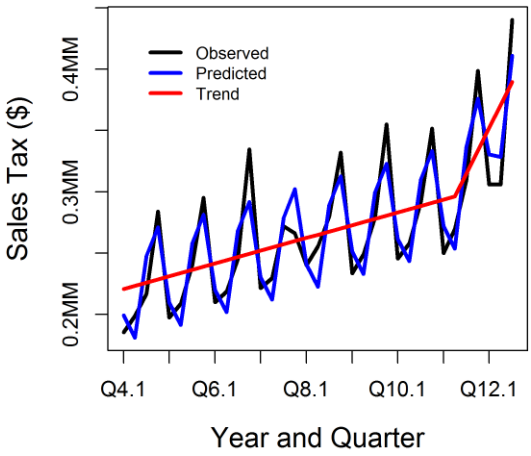


Figure 10: Bismarck food taxable sales cohort 5

Cohort 5 liquor sale were flat prior to the State and City ban announcements. An increase of $82,018 ($\alpha = 0.001$) in revenue along with a positive growth trend was experienced after 2005. The announcement of the city referendum is indicated by a revenue drop though it is statistically not significant ($\alpha = 0.05$).

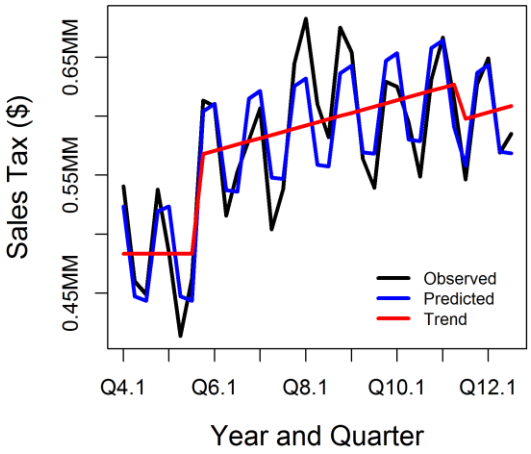


Figure 11: Bismarck liquor taxable sales cohort 5

Cohort 6 experienced all positive effects between policy periods. Post state and city ban announcements revenue jumped $35,402 ($\alpha = 0.05$) and the growth trend increased significantly ($\alpha = 0.001$). After enactment of the state wide ballot initiative this cohort benefitted from a $104,558 ($\alpha = 0.01$) jump in revenue.

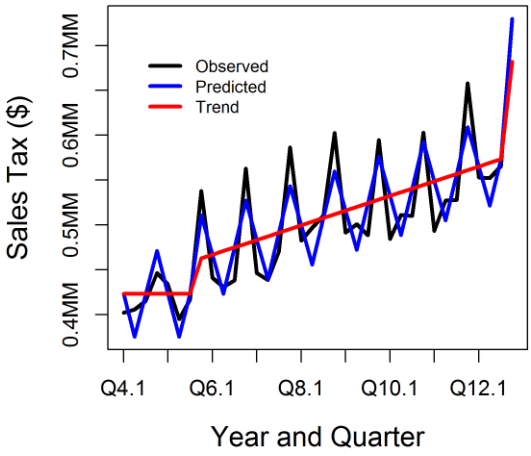


Figure 12: Bismarck food taxable sales cohort 6

Cohort 6 liquor experienced a negative but not significant reduction in growth after the Bismarck announcement and state law passed. The decrease in the trend was offset by near 20% (not significant) and 40% ($\alpha = 0.05$) increases in revenue after the referendum announcement and the passage of the state wide initiative. Sales in this group are highly variable and the cyclical variables are the most significant and have the greatest effect on revenue values. The time periods identified in this cohort for slope comparisons all begin on up cycles and terminate on downward cycles other than the initial starting trend.

Results in this group may be an artifact of sampling a small range of temporal points between policy announcements.

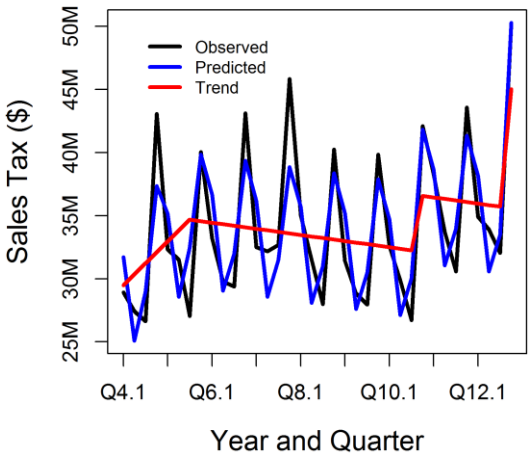


Figure 13: Bismarck liquor taxable sales cohort 6

Cohort 7 exhibits relatively uninterrupted growth with the exception of an increase in rate after the vote on the Bismarck referendum. The extremely large cyclical variability of these data has a large impact on any one revenue value in time.

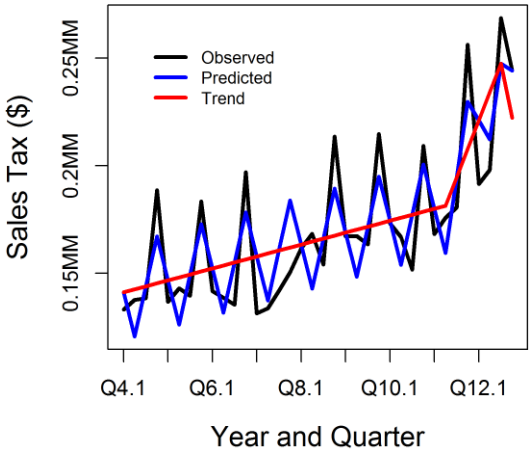


Figure 14: Bismarck food taxable sales cohort 7

Cohort 7 liquor is again highly cyclical with large dispersions around the trend line. Slope appears to have decreased though not significantly after I1 and then later with confidence after the Bismarck election.

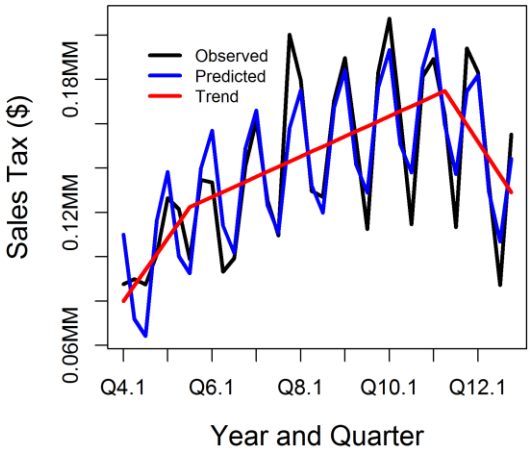


Figure 15: Bismarck liquor taxable sales cohort 7

Cohort 8 is the smallest of the Bismarck food revenue classes. This group experienced a very large positive revenue recovery with the announcement of the Bismarck referendum. The slow declining revenue trend experienced after 2005 continues even after the 50% increase in revenue. There appears to be a few abhorrent values associated with this group. The decreases in quarter 31, 34 and 37 reporting may be an artifact. These values appear to be extreme outliers for both the food and alcohol taxable sales.

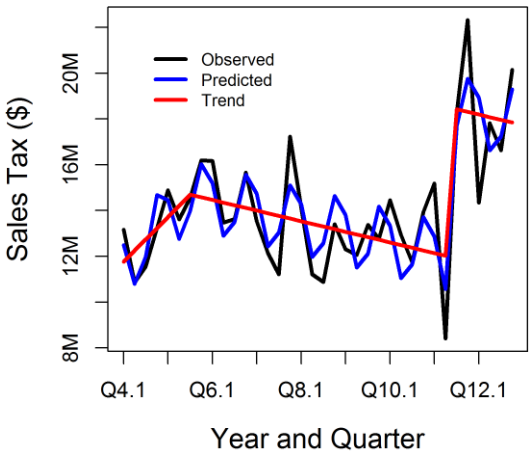


Figure 16: Bismarck food taxable sales cohort 8

Cohort 8 liquor displays a reliable trend until the outlier values discussed above are encountered. There is also an outlier in this data not associated with a test period.

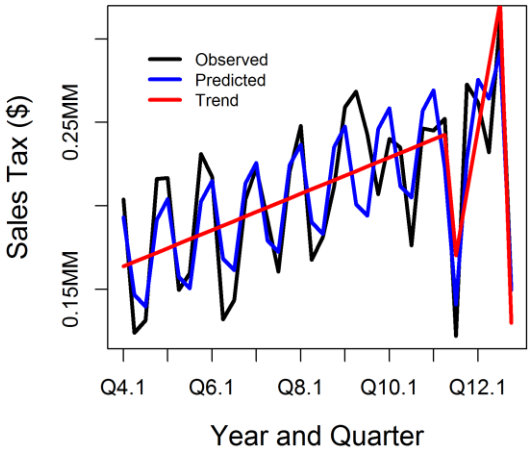


Figure 17: Bismarck liquor taxable sales cohort 8

Mandan Comparative Restaurants:

Mandan Cohort 1 experienced a decline in its revenue growth rate after the State and Bismarck bans. The trend remains stable through all subsequent policy points until the Bismarck election at which point revenue growth increase just as it did for all but two Bismarck cohorts. This suggests two possible drivers, changed expectations about the state wide outcome was positive, or some external factors were acting on both markets.

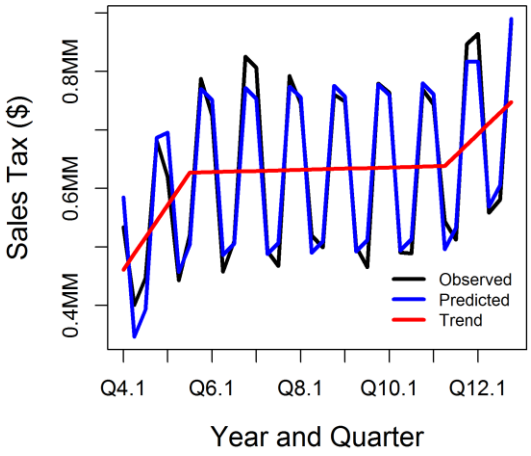


Figure 18: Mandan food taxable sales cohort 1

Cohort 1 liquor exhibits behavior completely counter intuitive to the hospitality association theory. The state wide ban had a much later implementation date and the Bismarck ban was expected to take effect nearly immediately. Rationally Mandan liquor sales should increase as smokers were assumed to have flocked to Mandan so that they

could continue to smoke and drink in restaurants.

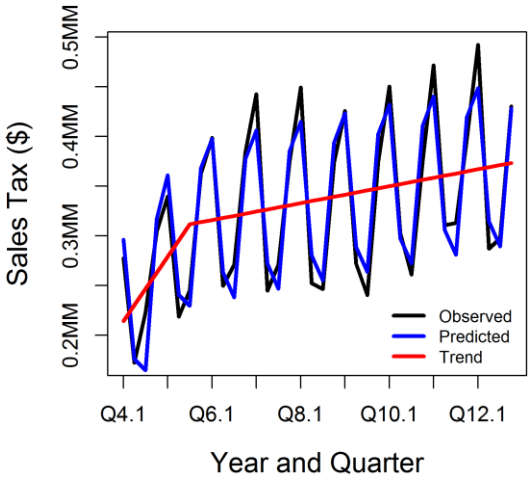


Figure 19: Mandan liquor taxable sales cohort 1

Cohort 2 exhibits a mix of somewhat rational behaviors, a decrease of revenue with the state wide ban but an increase in growth after the Bismarck ban, followed by a significant increase in growth rate after the Bismarck referendum passed and finally a decline after the state wide election. The 5.6% revenue shift was relatively small and was compensated for by the increased growth rate in 2011.

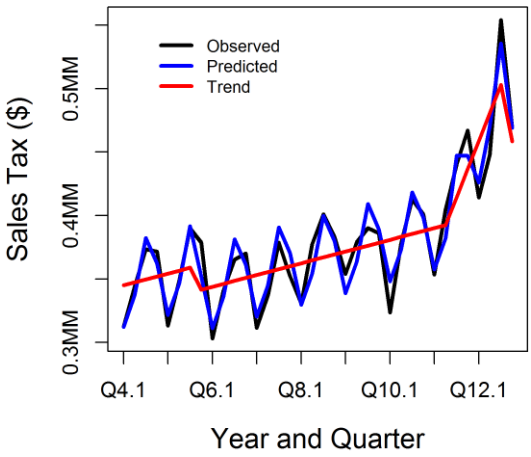


Figure 20: Mandan food taxable sales cohort 2

Counter to the food sales for cohort 2, liquor did not show any negative impact from the state or Bismarck bans. In fact liquor sales sharply increase with the smoking ban that affected Mandan and the Bismarck ban. Then contrary to logic this Mandan cohort had a revenue drop coincident with the Bismarck initiated measure, and then demonstrated

strong positive responses to the Bismarck election as well as the state wide ballot initiative. These results again iterate that strong positive results may be a result of recruiting new patrons due to the policies or that external factors are playing a larger role in revenue than smoking policy.

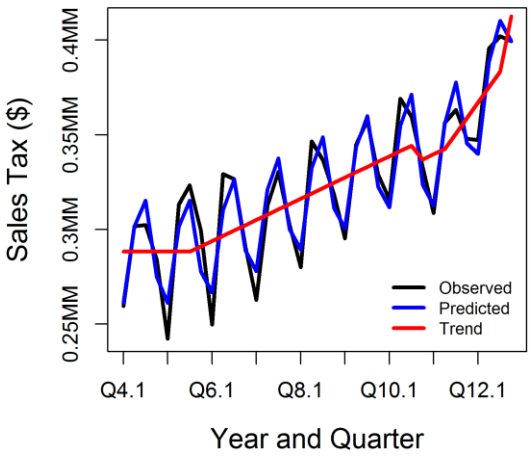


Figure 21: Mandan liquor taxable sales cohort 2

Cohort 3 revenue decreases in response to the state and Bismarck bans but growth rates increase sufficient to exceed the historic trend by 2008. The group also experience a further increase in revenue growth after the Bismarck initiated measure passed.

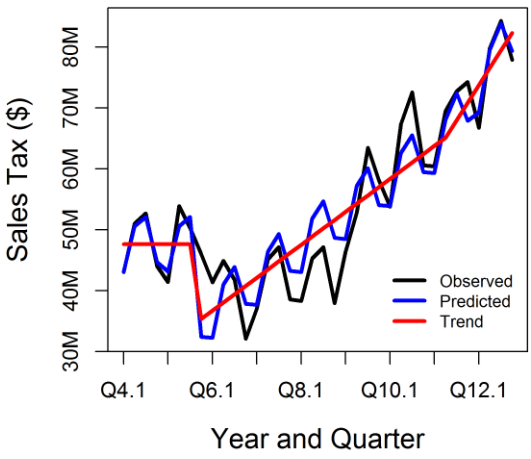


Figure 22: Mandan food taxable sales cohort 3

Cohort 3 liquor revenue is highly cyclical and variable. The group experienced a revenue increase with the state and Bismarck bans, a revenue drop with the Bismarck initiated measure announcement and again with its passage. The group then saw an increase in

growth after the Bismarck measure passed as well as suffered a loss in revenue upon passage of the state wide measure. These shifts both follow expectation and are counter. It is unclear if the cohort is responding to the policy or external factors.

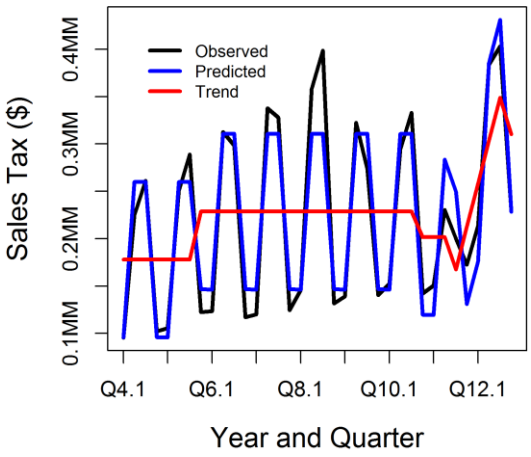


Figure 23: Mandan liquor taxable sales cohort 3

In the case of cohort 4 food revenue this group experienced shifts in both directions coincident with policy changes. It saw a drop with the initial state law which exacerbated an already rapidly declining revenue stream and then an increase with the more restrictive state wide measure resulting a revenue increase more than twice as large as the earlier drop.

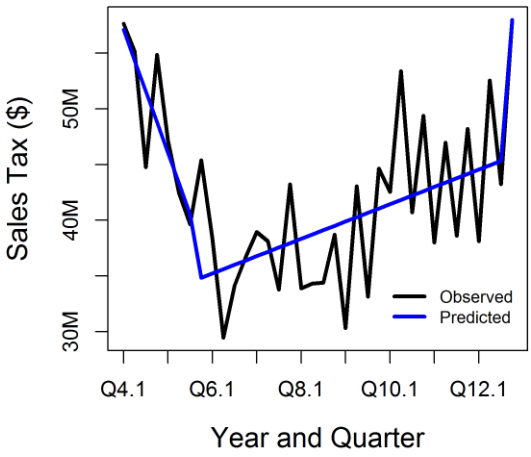


Figure 24: Mandan food taxable sales cohort 4

Cohort 4 liquor was on a rapidly decreasing revenue pattern and responded positively to the state and Bismarck bans. Then responded positively again to the Bismarck election and then benefitted from a 38% revenue increase with the state wide measure.

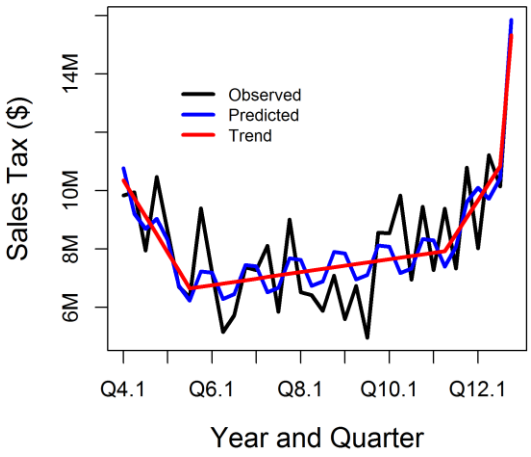


Figure 25: Mandan liquor taxable sales cohort 4

Discussion

The response of the larger market is the higher priority because that is where the measure of public welfare is derived. Public policy is not intended to benefit or cost individual actors but to maximize all the peoples wellbeing or what economists call welfare. We looked at the overall market for both Bismarck and Mandan as well as developed comparisons to state and national industry specific gross sales. The local markets tended to outperform the larger regional amalgamations as well demonstrating significant resilience to national economic downturns. The one state wide factor that may correlate to slowing revenue growth appears to be the decreases in disposable income at the state level during the peak of the recession. Even in this case the local restaurants still maintained a positive rate of growth during these events. The Bismarck food service industry also significantly outperformed the national food and beverage growth over the last 8 years. These results bode well for the health of the Bismarck restaurant and beverage markets.

Individual cohorts were impacted in both the positive and negative directions even though the overall market showed no signs of negative impacts from the bans. The majority of impacts were positive impacts on revenue streams with a few negative impacts where the negative impacts were mostly between 1 and 0.01% shifts though there are a few exceptions. In most cases where there were negative impacts, cohorts also tended to recover the revenue streams within a short period of time. Even so, significant negative results also tended to have the smallest revenue impacts. Positive effects were generally 10 to 1000 times larger than negative impacts but are difficult to generalize because there was a very large range of deviations and magnitudes.

The cohorts were made up of long-term actors in the market that reported during every period of the study. During the analysis period there were significant new entrants into the market. Reporting restaurants increase from near 50 restaurants to nearly120 in Bismarck and from 25 to approximately 50 in Mandan over the analysis time frame. Following the same cohorts as the population of restaurants doubles or more in each municipality makes within market competitive effects confounding. These large changes in market participation makes the generalized market evaluation a clearer picture of the actual market response to policy and macroeconomic phenomenon. When a shift downward was observed for a cohort or group of cohorts yet the market revenue stably increases, then other firms not included in the cohorts or new entrants into the market are the beneficiaries of the overall market revenue shifts and growth.

Mandan as a control has many positive and negative shifts for events that happened in Bismarck. Many are philosophically inconsistent with expectation theory. This inconsistency suggests other drivers during this time period may be affecting revenue in the regional market as a whole more so than local smoking policies. The divergence from the overall market trends for Bismarck and Mandan individual cohorts suggest other factors may be influencing these groups of restaurants. Individual positioning within the market, specific clientele demographics and number of competitors for specific market niches may influence individual and cohort revenue more than local or neighboring policy.

Just as in the 2007 study, it is evident that the Bismarck Restaurant/Bar market is both growing and becoming more competitive. During the timeframe of the study we more than doubled the number of firms and taxable revenue in the overall market. Competition between existing and with new firms seems to be the greatest contributor to revenue distribution. It is possible that measures of taxable revenue do not adequately characterize profitability. Differences in sources of revenue may affect entrepreneurial income. For the purposes of this investigation we have assumed that negligible changes (with most being positive) in total revenue are a sufficient proxy to suggest regulatory costs are not being transferred to restaurant owners and the smoking ban did not cause reductions in overall industry employment.

Role of government is to set policy in the interest of the market as a whole including consumers and suppliers. Though individual actors in the market may have different experiences than the market as a whole it is not the role of policy to attend to the individual economic actor. The response of the larger market is the higher priority because that is where the measure of public welfare is derived. The health benefits of smoke free environments have been well documented. These benefits are not offset by any significant direct or indirect cost to restaurateurs in Bismarck, North Dakota.

Future research on these specific industry impacts are sufficiently addressed with this study and the 2007 study for Bismarck. These results are not unique. There is a growing set of published studies that show very similar results. Future research should focus on stemming youth recruitment to nicotine addictive products. Tracking hospital admissions for smoking related disease over time in conjunction with smoking restrictions will

provide additional insights into the external benefits of the Bismarck and North Dakota health policies.

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Appendix 1 – Graphs and Charts

Deliverables:

1. A report detailing the measurable effects of Bismarck's smoking ban for bars and restaurants. The details will include:
   - Effect on Bars – **Complete**
   - Effect on Restaurants – **Complete**
   - Effect on Combined Bar-Restaurant Establishments - **Completed**
   - Effects on other license codes as feasible – **Data not provide by the state**
   - Effects on the overall market - **Completed**
2. An interpretation of the resulting effects - **Completed**
3. Recommendations for further analyses - **Completed**
4. Slides showing the results for use in Powerpoint presentations - **Completed**